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Title: The Magnetic Structure of H-alpha Macrospicules in Solar Coronal Holes

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Abstract: Measurements by Ulysses in the high-speed polar solar wind have shown the wind to carry some fine-scale structures in which the magnetic field reverses direction by having a switchback fold in it. The lateral span of these magnetic switchbacks, translated to the Sun, is of the scale of the lanes and cells of the magnetic network in which the open magnetic flux of the polar coronal hole and polar solar wind are rooted. This suggests that the magnetic switchbacks might be formed from network-scale magnetic loops that erupt into the corona and then undergo reconnection with the open field. This possibility motivated us to undertake the study reported here of the structure of H-alpha macrospicules observed at the limb in polar coronal holes, to determine whether a significant fraction of these eruptions appear to be erupting loops. From a search of the poler coronal holes in 6 days of image-processed full-disk H-alpha movies from Big Bear Solar Observatory, we found a total of 35 macrospicules.Nearly all of these (32) were of one or the other of two different forms: 15 were in the form of an erupting loop, and 17 were in the form of a single-column spiked jet. The erupting-loop macrospicules are appropriate for producing the magnetic switchbacks in the polar wind. The spiked-jet macrospicules show the appropriate structure and evolution to be driven by reconnection between network-scale closed field (a network bipole) and the open field rooted against the closed field. This evidence for reconnection in a large fraction of our macrospicules (1) suggests that many spicules may be generated by similar but smaller reconnection events, and (2) supports the view that coronal heating and solar wind acceleration in coronal holes and in quiet regions and corona are driven by explosive reconnection events in the magnetic network.